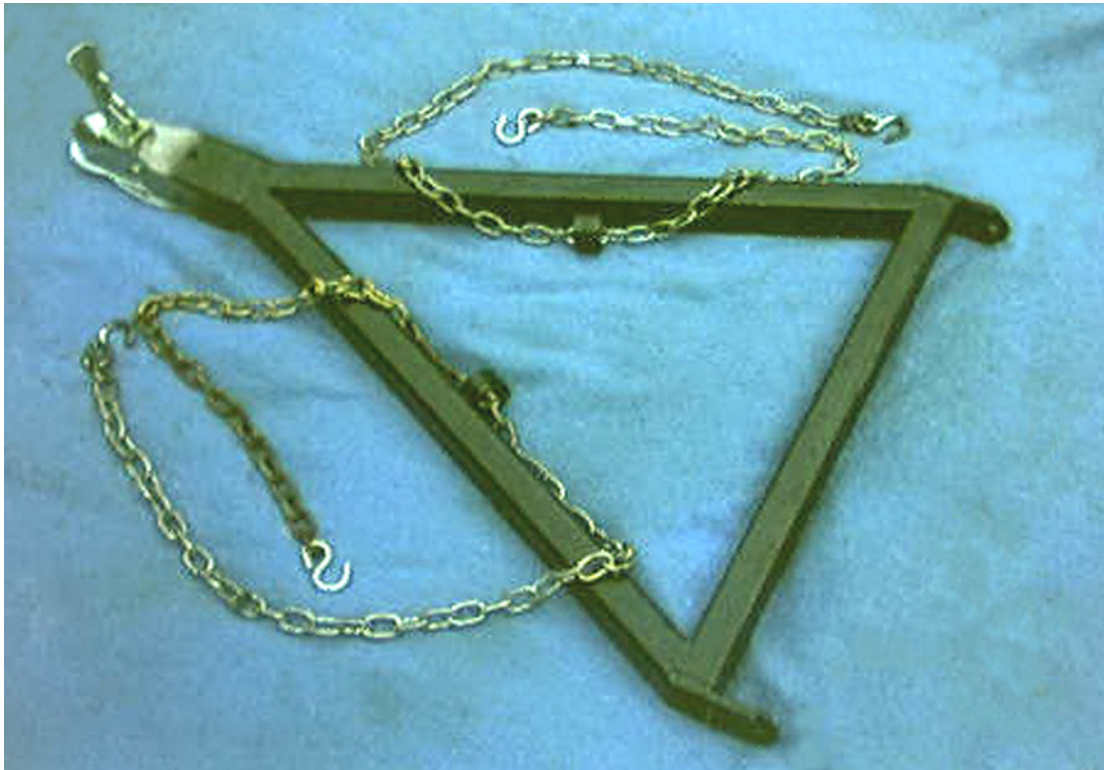


# 11946.001 Tow Bar Cookbook



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## Forward



I'm a metal crafter. There's nothing I like better than working in my shop making stuff out of metal.

I built this tow bar so I could move my converted 4X4 Toyota Celiac from place to place. I made it from scrap I have been tripping over for years.

This project is not very difficult but some of the drawings may look a bit intimidating. They're not really that bad if you take the time to study them and understand them. The templates supplied as an option are real time savers. The drawings (also an option) are supplied in PDF format that you can take to any office services store (like Kinkos ®) for printing or you can purchase full sized prints.

The pivot bracket (page 12) is of a generic configuration. It fits my modified Toyota (Figure 1) really well because I modified the car to make things easy for myself. It is unlikely it will fit every application. You will probably have to make a slightly different bracket. You must attach whatever bracket you use to a suitable structural member of the vehicle to be towed or attach a suitable bar to the towed vehicle.

Bumpers on modern vehicles are **not** structural members. **Do not** attempt to attach this device to the vehicle **bumper**. Many GM cars have significant structure **under** the front bumper cover. In some GM applications, you can mount the pivot brackets **through** the outer cover on to the structure behind. A prudent person would investigate the application thoroughly before attempting to use this device. For some applications, you may have to attach additional bracketry.

If you're an experienced craftsman and if you have the right tools, you can probably make it over the weekend. If you're a novice, it may require a bit more time but there's really no particular rush. Take your time and have fun. If you have any questions, I'm happy to help. Do not be concerned about writing or sending an e-mail ([dslee@together.net](mailto:dslee@together.net)). I'm happy to hear from anyone making my projects.

I made this tow bar 5 years ago. I've towed numerous vehicles since from an '86 Toyota 1/2-ton pick-up to an '88 Sunbird stock car without a hint of a problem. The pick-up was towed 86 miles partially over back, country roads (paved and un-paved) and partially at 65 MPH over a New Hampshire Interstate. Nothing bent or showed any signs of failure.

I'm a mechanical engineer, Ben Franklin Institute, class of 1965. I've worked in Aerospace, Shipbuilding, Robotics and Telecommunications. My dream is to be chief fabricator for a NASCAR Cup team.

- David Lee

## Introduction - Tow Bar Cookbook

Welcome and thank you for purchasing the **Tow Bar Cookbook**. I'm sure you're anxious to start cutting, drilling and welding but it would be a good idea to breeze through this brief introduction first. In the following text, I'll explain some things you should know before you begin.

### **1. Drawing Convention**

I've made the drawings in ANSI format. It's what I'm familiar with and what I've used to make engineering drawings for over 30 years. I've purchased mail order drawing packages myself in the past. Some were comical, hand drawn cartoons, most looked like they were done on somebody's kitchen table with a ruler and lined paper and none had much value. I sincerely hope you'll find my drawing package easy to follow, accurate and worth the cost. They are all CAD generated and all the pieces, parts and assemblies were actually made from the drawings. If you find any errors, please contact me.

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### **2. Axial Dimensioning**

The drawing is available in inch/fraction, inch/decimal and centimeter dimensioning. I strongly recommend either the inch/decimal or the centimeter version. Many times, things just don't work out to an equal 32nd of an inch. The CAD will round things off to where ever it's programmed to. This builds in an error of as much as .015". If there are ten such round-off's in an assembly and they all go in the same direction, the result is a total error of .15" (.38cm) (or 2.4/16's if you're so inclined). I use a Craftsman tape graduated in centimeters. It cost a whopping \$12.99 and I've seen them at Home Depot for about half that. A decimal tape is the same price. All the parts and pieces were made from the centimeter dimensioned version of the drawings. If you give it a chance, after about 1/2 day, you'll probably agree that centimeters or inch/decimal are the way to go. If you're more comfortable with fractions, go for it. All the illustrative drawings in this manual are shown in centimeter dimension convention except for standard USA stock width and thickness, which are delineated in decimal English measure. If you desire, order the engineering drawings in the dimensioning convention you want. The actual engineering drawings included with your order will be delineated in whatever convention you want.

### **3. Angular Dimensioning**

Angular dimensioning is used on the drawings for reference only. I chose to show the angles only as reference dimensions because, for example, over a 30" length at 30°, an angle error of only 1° will result in nearly a .718" (1.8cm) error in the opposite side. Please don't try to use a protractor. Use the axial coordinates to make angle cuts.

## 4. *Welding Symbols*

I've uses AWS welding symbols in the drawings. Although some appear a bit intimidating, they're really quite simple once you understand. Farther along in this manual, I've shown a simple explanation of the symbols used. If you have any questions, e-mail me at dslee@together.net.

## 5. *Materials of Construction*

Unless I've specified otherwise, hot rolled steel is adequate for construction. Many folks call any steel that's not stainless **cold-rolled** when they actually mean low carbon, mild steel. M1010 hot rolled is a low carbon, general purpose, merchant quality steel that is economical and weldable. You can also use 1008, 1018 or 1020 with satisfactory results. If you have some steel stock lying around that meets the dimensional criteria and it can be cut, drilled and welded, use it. If you go to a salvage yard to buy the stock and ask for M1010 hot rolled, you may get just a blank stare. Here's the ID end color. Go to the rack, pick out what you want and pay for it.

M1010 - black

M1020 - none

1018 - ????

1018 & 1020 - green

Schedule pipe is rated, not actually by its wall thickness, ID or OD, but by its liquid flow and working strength. That's why 1/8", schedule 40 pipe is over 3/8" OD and over 1/4" ID. The formula for determining wall thickness is so complex it's not worth discussing here. Unless the actual flow and strength are important, if the drawing says "1¼ inch pipe", use any stock that's somewhat round and about 1¼" ID.

## 6. *Closed Tubing Ends*

All my creations are designed with closed tubing ends wherever possible. The reason is to keep from oxidizing the inside walls. Steel won't corrode if it can't get oxygen. Since we can't conveniently paint the inside wall of a two foot long bar, we try to seal the ends. Once the iron in the steel uses up all the available oxygen, it won't corrode any longer. I suggest you make a conscientious effort to produce an airtight weld everywhere you can.

## 7. *Recommended Tools*

Farther along in this manual I've provided a list of recommended tools, both hand and power. If you don't have at least the minimum recommended apparatus you may want to reschedule construction for another time or use this project as justification to buy some nice, new tools.

## 8. *Tolerances*

No dimensions are toleranced unless necessary. I recommend using a +/- .015" (.04cm) allowance as a general rule. In most cases, a +/- .030" won't matter much. If the feature or its location needs a tight tolerance, the drawing will say so. The booklet text explains the function of each part and each feature of the part to allow you to make your own decision regarding +/- variation.

## **9. Templates**

Included in the document package are 1 to 1 scale templates printed on nice, heavy 22 lb. paper. It's fine if you'd rather layout the hole centers with a square and scribe. I've found, however, that it is much easier and more accurate to use the templates. Cut on the outline with a hobby knife and metal straight edge. Tape the template accurately to the stock after you've cut it to the proper size. Lay the work down flat on your work surface and prick where the centerlines cross with an automatic punch first, then put in a good sized dent with a big center punch and hammer, strip off the template and drill.

## **10. Disclaimer**

I have **not** made and will not make any representation or warranty of merchantability or fitness or any other representation or warranty not set forth here-in and I shall not be held liable for any consequential or indirect damage, including loss of life, as a result of the use or misuse of the equipment described here-in. I do not assume liability or responsibility for any personal injury, property damage or loss construed as a result of purchasing these documents. Copyright © 2003.



**Figure 1 - Tow Bar Attached to Toyota Celica**

## Recommended Tools

Figure 2 - Recommended Tools

Function	Minimum	Recommended
Cutting	Reciprocating Power Saw or Abrasive Cut-off Saw (Chop Saw)	Cut-off (Horizontal Band) Saw
Drilling	3/8" Power Drill	1/2" Drill Press
Welding	100 amp Stick Welder	150 amp TIG or MIG Welder
Grinding	4½ " Power Grinder	7" Power Grinder or 9" Power Grinder
<b>Hand Tools</b>	Hammer (16 oz) C-Clamp (6"), two each 6' Tape Measure in Fractions 12" Combination Square Center Punch Automatic Center Punch 1/8" Dia Twist Drill (Pilot Holes) 5/16" Dia Twist Drill (Tap Drill) 25/64" dia Twist Drill ½" Dia Twist Drill 3/8"-16 Tap & Handle	Hammer (32 oz) ----- 2 meter or 6' Decimal Tape Measure ----- ----- ----- ----- ----- ----- ----- -----